Sedimentation in Illinois Lakes:

How Sediment Surveys Help Us Learn What We Need to Know

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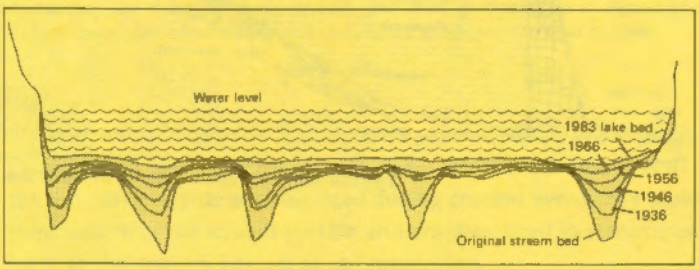


Sedimentation patterns in Lake Decatur

Soil erosion and sedimentation are natural processes that have been occurring for millions of years. But in the last century these processes have been greatly accelerated by human activities. Changes in land use from woodland and prairie to farmland, modern large-scale agricultural practices, and clearing of land for construction have led to excessive erosion and sedimentation.

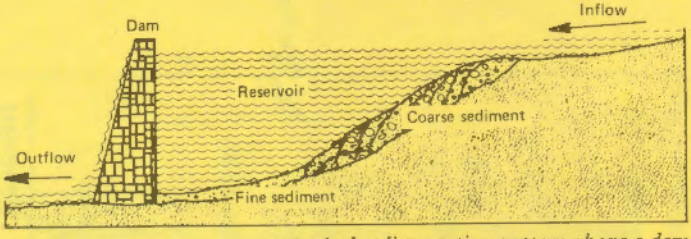
Sedimentation in Illinois lakes is recognized as a major water resource problem for the state. It is essential that the state know which lakes are subject to excessive sedimentation in order to better manage its water resources so future needs may be met.

Lake Sedimentation Patterns

Many Illinois lakes were formed by damming of a stream or river. As soon as a dam is constructed and the water is allowed to store, the lake starts to fill up with sediment. Rivers and streams transport sediment both in suspension and along the bed because of the energy contained within the flowing water. With creation of a lake, the flow area increases tremendously, which decreases the flow velocity of the water. Because of this decrease in flow velocity, the water moving within the lake cannot keep the sediment in suspension, and the sediment particles are deposited within the lake.

As soon as the high velocity stream water enters the semi-stagnant water of the lake, heavy and coarse sediment particles such as pebbles, gravels, and sands settle down immediately. Fine-grained particles such as silt and clay may remain in suspension for a long period of time before being deposited in the deeper part of the lake.

In time, the upper part of the lake fills up with sediment, creating marshy, muddy flats with willows, brush, and vegetation. This sediment deposition ultimately reduces the lake storage capacity.



Typical sedimentation pattern above a dam

Determining Lake Sedimentation Rates

Lakes lose their capacities at different rates, depending on the characteristics of the lakes and their watersheds. The rate of capacity loss for a given lake can also change over time. It is therefore important to know the rates at which individual lakes are filling with sediment. Only then can the state manage its water resources efficiently and know how to plan for future water needs.

Since the early 1930s the Water Survey and other agencies have conducted lake sedimentation surveys to determine the rates at which sediment is accumulating and lake storage capacities are being lost. Recent surveys have also included analyses of water and sediment quality and the sources of sediments. However, Illinois currently has no systematic lake sedimentation survey program.

How Sedimentation Surveys Are Conducted

A sedimentation survey determines the present water-holding capacity or volume of a lake. It also determines the amount of deposited sediment within the lake.

Before a lake survey is begun, a plan view is drawn from existing maps or aerial photographs, and a set of range lines is selected where measurements will be made. The depth of water is normally measured with a marked and calibrated sounding pole or sounding line. The pole is then pushed through the deposited sediment until it touches the original solid ground. When the present lake bed elevation is compared with the elevation of the original lake bottom (or with the bed elevation from a previous survey), the thickness of the accumulated sediment can be determined.

Once the depth of the water and the thickness of sediment at each range line are determined, various geometric and trigonometric equations are used to compute the total present water volume of the lake and the volume of the deposited sediment. These data show the rate of capacity loss between two consecutive surveys. Repeated surveys at intervals of 10 to 15 years are needed to determine the long-term variability of the sedimentation rates.

What Sedimentation Surveys Have Shown

Sedimentation surveys conducted by the State Water Survey show that Illinois lakes are losing their capacities at the rate of 0.2% to 4% a year. At least twelve lakes are losing their capacities by more than 2% a year. If this rate continues, these lakes will lose half of their capacities in about 25 years.

The following listings briefly indicate some of the sedimentation problems in three Illinois lakes and the types of information that have been gained from sedimentation surveys.

Lake Springfield

Purpose and main uses: Built in 1934 to provide potable and industrial water to the city of Springfield.

Capacity loss: 0.3% per year; 14% of the original capacity has been lost since 1934.

Effects of sedimentation: The lake is very susceptible to droughts. Sediment deposition reduces the effectiveness of the lake in providing potable water during low rainfall periods. Deposition has created large areas of mud flats and shallows in upstream portions, promoting noxious weed growth.

Lake Decatur

Purpose and main uses: Built in 1922 to provide water supply to Decatur's industries and residents during low rainfall periods.

Capacity loss: 0.5% per year, or one-third of the original volume and average depth since 1922.

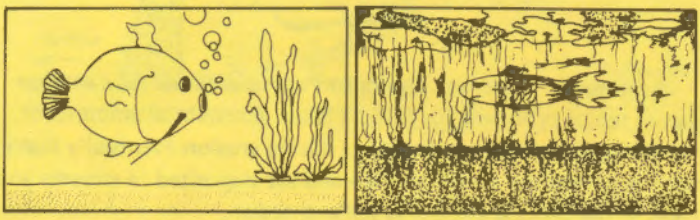
Effects of sedimentation: Large areas of mud flats and shallows promote noxious weed growth. High turbidity, nitrate levels, and bacterial levels have caused permanent closing of public beaches. High nitrate levels periodically endanger the water supply.

Horseshoe Lake (Alexander County)

Purpose and main uses: A naturally-formed lake; one of the most unusual wildlife and aquatic habitats in Illinois. Large stands of cypress trees grow in the lake, and 100,000 Canada geese winter there. The lake is also used for fishing and boating.

Capacity loss: 1% per year; one-third of the volume and average depth have been lost since 1951. If the current rate continues, this unique lake will be completely useless within 50 to 75 years.

Effects of sedimentation: Shallowness of the lake (average: 3 feet) has promoted eutrophic conditions, noxious weed growth, and fish kills due to temperature extremes and low levels of dissolved oxygen.



Future Outlook

A regular lake sedimentation survey program can identify the lakes that are losing their capacities most quickly. It can thus sound the alarm long before lake capacity loss becomes a critical problem as a result of natural causes such as droughts. Land and water management measures can then be used to relieve or solve the problem.

In February 1985 the State Water Plan Task Force unanimously recommended that a regular lake sedimentation survey program be initiated by the state, to be housed at the Water Survey. It is hoped that such a program will protect many lakes that are in danger of losing their much-needed water capacities.

WHEREAS, Illinois' 2,900 lakes and 81,000 ponds provide inestimable economic and aesthetic benefits including drinking water, fishing, swimming, boating, cooling water for utilities and industry, and flood control; and

. . . WHEREAS, the Illinois State Water Plan and the Water Quality Management Plan have identified soil erosion as the number one water resource issue facing Illinois and have documented the economic impacts of erosion on Illinois lakes; and

WHEREAS, Soil and Water Conservation Districts, municipalities and homeowners' associations are working together with state and federal agencies to solve lake and watershed problems;

THEREFORE, I, James R. Thompson, Governor of the State of Illinois, proclaim April, 1985, as LAKE AND WATERSHED COOPERATION MONTH in Illinois, in recognition of the value of our water and soil resources, and I urge Illinois citizens and local governments to renew their commitment for regular lake and watershed maintenance at this time.

As noted in Governor Thompson's proclamation, soil erosion causes major problems for Illinois lakes. Substantial amounts of the soil particles that are dislodged during erosion eventually make their way into the stream system and are deposited in streams and lakes in the process known as sedimentation.

Gradually, as more and more sediment is deposited in a lake, its capacity is diminished, lessening the amount of water it can store. In Illinois about 5.6 million people rely on surface waters for potable water. About 1.1 million of these receive their water from small lakes and reservoirs. Maintenance of lake storage capacities is thus extremely important to millions of people in numerous Illinois communities.

In addition to reducing lake storage capacity, sediments are a pathway through which contaminants and excessive nutrients can enter a lake. Sediments in lake waters can also limit the capability of lakes to sustain habitats that support aquatic life, can cause turbidity that interferes with lake recreation, and can add to the damages caused by floods.

Information and data on sedimentation surveys were provided for this brochure by William C. Bogner and William P. Fitzpatrick, Illinois State Water Survey. The brochure was edited and designed by Gail C. Taylor, publications editor at the Water Survey.

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